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(54) Title: PROCESS FOR THE PREPARATION OF NUTRITIONALLY VALUABLE PRODUCTS FROM CEREALS

(57) Abstract

The present invention relates to a process for the preparation of protein enriched, nutrition physiologically high valuable products of whole cereals, such as wheat, oat, barley, rye and sorghum, whereby one: 1) grounds cereal raw material to a particle size not exceeding 0.5 mm, decomposes enzymatically the polysaccharides present using an alpha-amylase at 50 to 55 °C and pH 5.2 for 180 min for hydrolysis to oligosaccharides and higher glucose polymers and a highest amount of 15 % of glucose, decomposes the proteins present using a proteolytic enzyme at 50 to 55 °C and pH 5.5 to 7.5 for a period of 60 to 120 min to a decomposition of 40 to 60 % of the proteins present to soluble components by degrading at most 6 % of the peptide bonds, whereupon the product is sterilized by heating to a temperature inactivating the enzymes present, and 2) wheat gluten is added to water containing a proteolytic enzyme, whereupon the mixture is incubated at a temperature of 50 to 55 °C at pH 5.5 to 7.5 for a time period of 60 to 120 min, the wheat gluten hydrolysis product optionally being provided with an alpha-amylase for starch present in the wheat gluten, whereupon the products according to 1) and 2) are brought together to a protein content of 12 to 40 % calculated on the dry matter content, whereupon the mixture thus obtained is optionally dried.

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PROCESS FOR THE PREPARATION OF NUTRITIONALLY VALUABLE PRODUCTS FROM CEREALS.

The present invention relates to the preparation of nutrition physiologically valuable products intended for human as well as animal use starting from different cereals as a raw product. The aim has been to develop a process technically strongly simplified process which facilitates production under simple conditions and without too heavy investments comprising separation equipment etc. There is also an advantage in that the process developed only requires a few unitary operations at the preparation of components to feed stuffs, which requires large production capacity.

Another fundamental idea of the present invention is to produce products, "total cereals", where all nutrition physiologically valuable components of the cereals, such as fibres, proteins, fat, vitamins, trace elements and energy providing carbohydrates, are present in the end product. It is only the carbohydrates and in some cases the proteins which are converted to soluble, taste and functionally still more valuable components.

Different cereals can be used as raw materials, i.a. wheat, oat, rye, corn, sorghum and others. The aim is, that in each case provide the final product with an optimal composition for the intended use.

As all components of the raw material are present in the final products and the process has been simplified as far as possible the losses become very small and the yield is almost 100%. Furthermore, no sewage water or other environmental problems are created.

The process according to the present invention is adopted with regard to the use of the final product and different alternative processes have been developed.

The enzymatic decomposition of the carbohydrates are regulated through the choice of enzymes and the incubation conditions to the raw material used and desired final composition of the mixture.

Raw materials rich in beta-glucans and other polysaccharides other than starch are treated, in some cases, with enzymes suitable for the decomposition of these and for decreasing the otherwise very high viscosity. According to certain investigations made it is proposed that beta-glucans have a cholesterol lowering effect and thus it may in certain fields of use be motivated to to have this component left and intact in the final product. This is due for products based on oat.

When used as a food stuff it is sometimes desirable to have a higher concentration of soluble protein fragments i.a. in order to obtain a positive taste profile of the final product. In other cases one wants a low concentration of soluble proteins and thereby a more neutral taste.

A high amount of soluble proteins are desired when it comes to feed stuffs and in some cases the protein content is increased by supplementing with extra protein, i.a. an enzymatically pretreated wheat gluten. As a replacer for skim milk powder one wants e.g. a total protein content of about 35%.

For some fields of use the final product containing soluble as well as insoluble components can be used directly in the formulations to be made up without a preceding concentration or drying. This is due i.a. in some baking situations where one under all circumstances adds water. A costly removal of water can thus be avoided. If a longer storability should be desired, the product, being sterile after the process, be packed in such a way that an infection is avoided.

In most cases, however, a dry and powderous product is desired which is achieved by a suitable drying, preferably spray drying

or roller drying. In these cases it is of importance that the final concentration of glucose does not exceed 15%. The fibre fraction has to be finely divided at the drying which is obtained by a fine grinding of the raw material. Alternatively the reaction product may be finely divided by wet grinding before the finalizing sterilization and drying.

Detailed description of the invention

The process of the present invention can with regard to the desired use and thereby its composition of the final product, be varied in accordance with the following.

As raw material whole grains of cereals such as wheat, oat, barley, rye, corn or sorghum are used. The disintegration of the cereals to a desired particle size of 0.05 to 0.5 mm is obtained by conventional grinding. It is preferably the fibre fraction which need to be finely divided depending on the design of the drying equipment and the demands raised on a low sedimentation rate of the final product in case it shall be part of water suspendable products, e.g. feed stuffs for young animals or the like.

For human use of the final product, oat, barley and rye should be freed of their irritating husk before grinding.

1) Products having a high content of soluble proteins

From an apparatus point of view the main components of the equipment can be restricted to a vessel provided with a stirrer and possibility to maintain the desired temperature by indirect heating with water and optionally steam, a sterilizing unit, and for certain purposes, an evaporator or drying equipment.

It is most often suitable to have separate vessels with stirrer for the different phases and intermediate heat exchangers in order to obtain a better heat economy and a more semi-continous production. It is however, essential that there are possibilities to provide an equipment which is restricted to one vessel

with a stirrer and possibility for controlling the temperature. If the product is to be used directly without prior concentration it is also possible to sterilize in the starting vessel by keeping the temperature at 85°C for 15 to 30 minutes.

The finely divided raw material is added while stirring to water having been preheated to a temperature of 50 to 55°C and having been provided with a thermo-stable alpha-amylase, suitably Termamyl 120L (Novo) or a corresponding one, as well as a proteolytic enzyme active at a pH of 5.5 to 6.5, suitably Neutrase 0.5L (Novo).

During the incubation at maximum 55°C for 60 to 120 min. about 50% of the protein is decomposed to soluble fragments and 25% thereof to finely dispersed protein particles. The proteolytic enzymes being present in the cereal grains contribute to the total proteolytic activity as well.

The proteolytic decomposition has, in order to avoid a bitter taste, in accordance with the invention being so adopted that the degree of hydrolysis of the peptide bonds does not exceed 6%. Some of the proteins of the raw material are not dissolved but are released into the mixture in the form of small particles of partially degraded protein. These latter are characterized by a good water retaining capability and small sedimentation rate in aqueous emulsions.

In order to decompose the starch as well, and to reform into soluble components the temperature is increased during 30 min to 85 to 90°C. Then further Termamyl 120L is added and the incubation is continued for 60 to 90 min at 85 to 90°C. By continuously determining the amount of soluble dry substance (TS) during the incubation by using a refractometer a suitable end point can be determined, i.e., when no further increase of the TS can be determined. The mixture is then cooled to 50 to 55°C and pH is then adjusted to 5.2 using hydrochloric acid. Then an alpha-amylase is added, suitably Fungamyl 800L (Novo) as well

as a beta-glucanase, suitably Finizym 200L (Novo), whereupon the mixture is incubated at 52°C for 180 min.

In those cases beta-glucans are wanted in the end product no beta-glucanase is added.

When the desired composition has been obtained pH is adjusted to 4.8 by adding hydrochloric acid and the temperature is increased to 85°C whereby the enzymatic reactions are stopped. A final deactivation of the enzymes and a sterilization of the end product is obtained by indirect heating to 135°C for 30 to 60 sec. followed by cooling to 60°C.

The mixture can now be used directly for certain purposes, in other cases first after having been concentrated to a wanted TS and after storage in a suitably designed vessels in order to avoid infection thereof. Aseptic package is possible for certain purposes.

In most cases however, the product is dried using a spray drier directly or after a preceding concentration. Alternatively, the product can be roller dried as well.

2) Products having a low content of soluble proteins

If a product having a low content of soluble proteins shall be prepared the process is designed as follows:

The finely divided raw material is added while stirring to water having been pre-heated to 5o to 55°C and having been provided with a thermostable alpha-amylase, suitably Termamyl 120L or a corresponding one. When all finely divided cereal has been added the temperature is increased during vigorous stirring to 85°C and when this temperature has been reached further Termamyl 120L is added and the incubation is continued at this high temperature for 60 to 90 min. By following the the increase of soluble TS refractometric during the incubation a suitable fend point can be determined.

During the temperature increase phase from 55°C to 85C the enzymes present in the cereals, i.a. proteases can act some time before being inactivated and thus 10 to 15% of the proteins will be reformed to soluble fragments. The amount of soluble proteins depends however, on the contents of proteins of the raw material.

The mixture is cooled to 50 to 55°C and pH is then adjusted to 5.2 using hydrochloric acid. Then an alpha-amylase, suitably Fungamyl 800L, as well as a beta-glucanase, suitably Finizym 200L, are added. Then the mixture is incubated at 52°C for 180 min. As in alternative 1) beta-glucanase can be avoided if one wants the beta-glucans present in the final product.

When the desired composition has been obtained pH is adjusted to 4.8 by adding hydrochloric acid and the temperature is increased to 85°C whereby the enzymatic reactions are stopped. A final deactivation of the enzymes and a sterilization of the end product is obtained by indirect heating to 135°C for 30 to 60 sec. followed by cooling to 60°C. The final treatment of the product can be done in either of the ways having been disclosed in alternative 1) above.

3) Products having an extra supplementation of proteins

For certain purposes it is motivated to increase the protein contents of the final product by adding extra protein. This is due inter alia when product shall be used as an alternative for skim milk powder in foodstuffs or as an additive to feedstuff products. In the latter case the protein content should be increased to a total of 35%, but in other cases a protein content of between 15 and 20% can be of interest.

Hitherto, wheat gluten has turned out to be the most suitable one as an extra protein addition from a practical as well as an economic point of view. Wheat gluten can however, not be added to the dried final product by dry mixing, as a inhomogenous

product is then obtained which provides for a great risk for fractionation at storage and handling.

Moreover, the wheat gluten has to be pretreated in accordance with the present invention in order to eliminate its property to transfer into dough consistency at a mixture with water. This property will otherwise result in the formation of lumps and an inhomogenous end product is impossible to dry, as well as other process technical difficulties will occur.

According to the present invention the wheat gluten is thus treated with a proteolytic enzyme and will thereby lose its dough forming property and can be used in this case as a supplement without any difficulty.

Wheat gluten is added while stirring to water having been preheated to 50°C and provided with a proteolytic enzyme, suitably Neustrase 0.5L. The mixture is incubated at 50°C for 120 min. The proteolytic degradation has, in accordance with the invention, been adopted in such a way that no bitter taste will occur and the protein is only partly dissolved but otherwise in fine particular form so that no settling problem will occur.

A calculated amount of this protein slurry is then added to the product of cereals prepared in accordance with alternative 1) above. The components are mixed carefully by stirring immediately prior to the finalizing sterilization and drying. A homogeneous and in water readily suspendable product is obtained having a protein content as desired.

<u>The field of use of the products.</u>

The products prepared according to the present invention can due to their nutrition physiological and functional properties be used in many fields. They contain all the valuable components present in the starting material, i.a. dietary fibre, proteins, fat, carbohydrates, vitamins, and trace elements. The carbohydrates have been transformed to more easily resorbable

components having a delicious, sweet taste. They do not contain saccharose, which from the point of view of caries is of great value.

The oligosaccharides and glucose polymers formed can, in accordance with the research carried out during the last years be expected to have a biological activity against certain bacteria and while not least have a normalizing effect on the intestinal flora of humans and of animals, as well.

Even if the intended uses are any and different some of the more important will be shown below.

Foodstuff uses

Products prepared in accordance with 1) and 2) above differ only with regard to the content of soluble proteins and thus they have quite a similar use. The taste caused by the soluble proteins can be of advantage in certain circumstances, while in others one prefer a more neutral, sweet taste. An improvement of the functional properties have also been shown with regard to the partially degraded proteins.

Bakery uses

Primarily products prepared of wheat have been evaluated and then primarily those having a higher content of soluble proteins (alternative 1). These products are preferred due to the appreciated taste of malt they give to the bread.

Products having a high as well as a low contents of soluble proteins can, however, be used with advantage as additives at the baking of different types of plain bread.

The powderous products facilitates a simple and non-sticky handling and serve as an excellent yeast nutrient and can advantageously substitute common bakery syrup or sugar.

At an equivalent weight exchange better dough properties,

faster fermenting and larger volume of the final bread. The total yield of loafs thus become larger. Empirically one has found a considerably better storability of the bread.

In the course of development of new products within the bakery sector bakery mixes or bakery concentrates have been produced for common white bread as well as loafs of different types. 5 to 30% of the flour and other dry ingredients have been replaced with the products of alternative 1) and 2) with improved baking results.

The lower sweetness of the cereal products compared with syrup and sugar is not regarded as a negative factor but the products are well suited for most thick breads, rye breads, sports and fibre breads.

Aid food

Every year nature-catastrophes occur in some part of the world due to earth quake, dryness, thunderstorms, or the like. At such circumstances it is important to provide all types of help and not least to provide food to the people struck.

It is then essential to provide aid of well composed food not only containing energy providing components but also nutrition physiologically important components as protein, vitamins and minerals.

Products prepared in accordance with the present invention fulfils these demands and the carbohydrates have moreover been transformed not only into well tasting components but have a normalizing effect on the intestinal flora due to the content of biological receptors and can simultaneously inhibit optional diarrhoea.

In many places around the world the people suffers form lactose intolerance and can not stand food containing lactose. The products prepared in accordance with the present invention are

preferred for this reason as well as they do not contain lactose. As previously mentioned they do not contain saccharose either which from a caries point of view is an advantage.

As there often is a lack of tap water of good quality in the countries hit it may be motivated to send them non-dried, and thus water containing products. They will then obtain a nutritionally highly valuable product and simultaneously water of good quality. A request is then that the product is packed in such a way that infection is avoided during transport as well as storage.

In many countries it should be an advantage to obtain the actual products not only in aid situations but also under normal conditions and of course primarily if the production then can take place in the country of question with own produced raw materials.

The process according to the present invention has, as pointed out above, been designed with regard to a simplicity which facilitates a future production also in developing countries, where the raw materials present can be transformed into nutrition physiologically valuable products and food ingredients.

Test having been carried out have shown that the products are well accepted not least by the undernourished children. These have recovered fast, they grew faster, and are freed from intestinal illnesses faster than a control group which did not receive the wheat hydrolysates.

As previously mentioned the corresponding products can also be prepared in accordance with the present invention starting from oat, barley, rye, corn or sorghum. Even if the composition varies depending on the raw material as a whole equivalent products are obtained having the same positive properties.

Other foodstuff use

The dried powderous products prepared in accordance with alternative 1) or 2) can advantageously be used in health food products and as nutrition physiologically important additives in a number of situations.

They can be used as breakfast cereals together with milk or fermented milk products. The taste profile can be varied by adding dried fruits, e.g. apples, bananas or different southern fruits.

In pelletized form they can be used directly or after an addition of flavouring agents, as well tasting and nutrition physiologically valuable snacks products.

In milk replacers and gruels for children as well as older people the products fill an important role both due its nutritional value and due to its pleasant mildly sweet taste without containing saccharose.

There are possibilities to enrich using extra protein, vitamins, and amino acids as well, in order to further improve the value of the products. Products having been enriched to a protein value of about 35% can replace the milk powder under some conditions.

Feedstuff uses

Under these conditions primarily products prepared in accordance with alternative 1) are used which can be added as dried components or be dried in admixture with other products present in the final composition. As pointed out above, the products can be used directly or become supplemented with extra protein so that the total amount of protein becomes up to 35%.

Non-supplemented products

These products have hitherto in a large scale been prepared from Swedish wheat as raw material and contain between 9 and 12% of protein depending on the protein content of the raw ma-

terial. Due to the content of nutrition physiologically valuable components having a certain receptor activity against bacteria a positive influence on the intestinal flora resulting in a better feedstuff exploitation and possibilities of eliminating feedstuff antibiotics. Subsequently similar products can be prepared starting from the other raw materials mentioned in the present invention.

Hitherto the use of the products have been examined primarily with regard to calves, chickens, and piglets, but applications are present for other animals as well.

Considerable feeding tests have been carried out on calves up to the age of 22 weeks. The product is adjusted to pH 6.0 to 6.5 before drying and the contents of calcium and phosphate were supplemented to the levels used in calf nutrients.

Tests were made using up to 10% admixture of the product as a replacer for the corresponding amount of whey powder. The results are all positive, the growths are good and no negative effects can be shown.

Tests have been carried out with a corresponding product for chickens and up to 20% admixture in the slaughter chicken feedstuff can be recommended. The growth is positively affected which is attributed to the better intestinal environment. After 32 days the chickens weighed 90g more than the controls, and the difference was highly significant. A weight difference was observed already after 18 days.

Simultaneously as the growth was affected positively the feedstuff consumption was reduced per kg added weight. No digestion disturbances or other negative effects were observed.

In a piglet feedstuff 20% of the product was admixed and trials were conducted from the age of 2 weeks to the age of 9 weeks. Indirectly a positive influence was determined on the intesti-

nal health and the micro flora of the intestine. A faster weight gain was observed and the diarrhoea otherwise frequently observed were avoided.

Protein supplemented products

A protein enriched product prepared in accordance with the present invention has been administered to calves using wheat gluten as a supplementing product.

Considerable trials have been carried out using 15 to 30 % admixture in commercial nutrients for calves whereby the contents of skim milk powder is reduced to a corresponding degree. The product was adjusted like in prior tests to pH 6.5 and with regard to calcium and phosphate to the levels used in calf feeds.

As in the calf tests above a good growth was observed and no adverse effect during the feeding period continued up to the age of 22 weeks.

The invention will be described in the following non-limiting examples.

Example 1

Preparation of a product having a high content of soluble proteins starting from wheat as raw material

40 kg of a Swedish autumn wheat ground to a maximum of 0.5 mm particle size were added little by little to 70 litres of water heated to 55C and provided with 25 ml Termamyl 120L and 55 ml Neutrase 0.5L as well as calcium chloride in such an amount that Ca^{2+} is at least 70 ppm. The pH of the water shall be at least 6.2 and is adjusted if necessary using hydrochloric acid, or sodium hydroxide, alternatively.

The mixture is incubated while stirring at 55^{o}C for 90 min. whereupon the temperature is carefully raised to 85^{o}C during a period of 30 min. Then a further 25 ml of Termamyl 120L are

added and the mixture is kept stirred at 85°C for 60 min. The dry substance content (TS) is determined continuously by a refractometer and shall at the end of the incubation period has increased to 28 to 30 %.

The mixture is cooled to 52°C and pH is adjusted to 5.2 using hydrochloric acid. Then 15 ml of Fungamyl 800L and 30 ml Finizym 200L are added, whereupon all is incubated at 52°C for 180 min.

pH is then adjusted to 4.8 by adding hydrochloric acid simultaneously as the temperature is raised to 85°C for inactivation of the enzymes. For final sterilization the temperature of the mixture is raised indirectly to 135°C for 30 sec. and is then cooled to 60°C.

The product can now be used directly or after a concentration or after drying with a spray drier or roller drier, alternatively.

The composition of the final product is dependent on the composition of the raw material. Starting from Swedish autumn wheat a product having a moisture content of 5% the following composition in percent of dry matter.

Protein	11.4% of which 51% is soluble
Dietary fibre	9.5%
Fat	1.8%
Glucose	6.3%
Maltose	41.2%
Maltotriose	12.5%
Higher carbohydrates	15.8%
Ashes	1.5%

Example 2

Preparation of a product having a low content of soluble proteins from wheat as a raw material

40 kg of a Swedish autumn wheat ground to a maximum of 0.5 mm particle size were added little by little to 70 litres of water heated to 55°C and provided with 25 ml Termamyl 120L as well as calcium chloride in such an amount that Ca^{2+} is at least 70 ppm. The pH of the water shall be at least 6.2 and is adjusted if necessary using hydrochloric acid, or sodium hydroxide, alternatively.

When all the wheat has been added the temperature is carefully raised to 85°C. Then a further 25 ml of Termamyl 120L are added and the mixture is kept stirred at 85°C for 90 min. The dry substance content (TS) is determined continuously using a refractometer and shall at the end of the incubation period has increased to 28 to 30 %.

The mixture is cooled to 52°C and pH is adjusted to 5.2 using hydrochloric acid. Then 15 ml of Fungamyl 800L and 30 ml Finizym 200L are added, whereupon all is incubated at 52°C for 180 min.

pH is then adjusted to 4.8 by adding hydrochloric acid simultaneously as the temperature is raised to 85°C for inactivation of the enzymes. For final sterilization the temperature of the mixture is raised indirectly to 135°C for 30 sec. and is then cooled to 60°C.

The product can now be used directly or after a concentration or after drying with a spray drier or roller drier, alternatively.

The composition of the final product is dependent on the composition of the raw material. Starting from Swedish autumn wheat a product having a moisture content of 5% the following composition in percent of dry matter.

Protein	11.4% of which 12% is soluble
Dietary fibre	9.5%
Fat	1.8%
Glucose	6.5%
Maltose	42.0%
Maltotriose	13.0%
Higher carbohydrates	14.3%
Ashes	1.5%

Example 4

Preparation of a product having 35% of proteins and a low content of glucose.

The wheat based carbohydrate containing component was prepared in the way disclosed in Example 1 above.

The supplementing protein is wheat gluten the moisture content of which is 6% and the composition in 5 of TS is further as follows:

Protein	75%
Fibre	<1%
Fat	7%
Carbohydrates	16%
Ashes	<1%

Wheat gluten is pretreated in the following way:

23 kg of wheat gluten are added little by little to 40 litres of water heated to 50°C and containing 100 ml Neutrase 0.5L and 20 ml Termamyl 120L. The pH of the water shall be at least 6.2 and is adjusted if necessary using hydrochloric acid, or sodium hydroxide, alternatively. The mixture is incubated while being stirred at 50°C for 120 min.

The fine particular slurry thus obtained is added to the end product obtained in accordance with Example 1 starting from 40 kg of autumn wheat. The total composition is stirred to provide

a homogeneous mixture and is then sterilized by heating to 135°C for 30 sec. and is then cooled to 60°C.

Even after the sterilization the mixture is kept homogeneous by an efficient stirring until dried by spray drying.

The protein enriched final product is light yellow and contains 5% of moisture and has the following composition in % of TS:

Protein	35.5%
Dietary fibre	6.0%
Fat	3.8%
Glucose	3.9%
Maltose	25.6%
Maltotriose	7.8%
Higher carbohydrates	16.2%
Ashes	1.2%

CLAIMS

1. Process for the preparation of protein enriched, nutrition physiologically high valuable products of whole cereals, such as wheat, oat, barley, rye and sorghum, characterized in that one

1) grounds cereal raw material to a particle size not exceeding 0.5 mm, decomposes enzymatically the polysaccharides present using an alpha-amylase at 50 to 55°C and pH 5.2 for 180 min for hydrolysis to oligosaccharides and higher glucose polymers and a highest amount of 15% of glucose, decomposes the proteins present using a proteolytic enzyme at 50 to 55°C and pH 5.5 to 7.5 for a period of 60 to 120 min to a decomposition of 40 to 60% of the proteins present to soluble components by degrading at most 6% of the peptide bonds, whereupon the product is sterilized by heating to a temperature inactivating the enzymes present, and

2) wheat gluten is added to water containing a proteolytic enzyme, whereupon the mixture is incubated at a temperature of 50 to 55°C at pH 5.5 to 7.5 for a time period of 60 to 120 min, the wheat gluten hydrolysis product optionally being provided with an alpha-amylase for starch present in the wheat gluten, whereupon the products according to 1) and 2) are brought together to a protein content of 12 to 40% calculated on the dry matter content, whereupon the mixture thus obtained is optionally dried.

2. Process according to claim 1, characterized in that the raw material in the first step is added to water having a temperature of 50°C and containing a thermostable alpha-amylase, whereupon the temperature is raised to 85 to 90°C, whereupon further alpha-amylase is added for incubation for 60 to 90 min for hydrolysis of the carbohydrates present whereby a maximum of 15% of the proteins are hydrolysed to soluble fragments as well.

3. Product according to claims 1-2.

4. The use of a product according to claim 3, as an additive as yeast nutrient at the manufacture of bread.

5. The use of a product according to claim 3, as a high worthy aid product for direct consumption or after admixture with fruits.

6. The use of a product according to claim 3, as an additive to milk replacers or gruel powders.

7. The use of a product according to claim 3, as an additive to feedstuffs for young animals, such as calves, piglets, and chickens.

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00513

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 23 L 1/105, C 12 P 19/14, 13/00, A 21 D 2/08, A 23 L 1/30, A 23 K 1/16

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 23 L; C 12 P

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	DE, A1, 2844896 (LYCKEBY STÄRKELSEFÖRÄDLING AB) 19 April 1979, see page 16, line 26 - page 17, line 9; page 17, line 29 - page 18, line 22; claims 1-3,10 --	1-6
X	US, A, 3157513 (WINSTON, F.A. ET AL.) 17 November 1964, see column 1, line 12 - line 14; claims 1,4,7 --	1-3
A	US, A, 3958015 (GAY, M.M.) 18 May 1976, see claims 1,4 --	1-7
A	US, A, 4391829 (SPRADLIN, J.E. ET AL.) 5 July 1983, see claims 1,11-19,22 --	1-3,7
A	US, A, 4810506 (LEWIS, V.M. ET AL.) 7 March 1989, see claim 1 --	1-3

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
30th September 1992	19 -10- 1992
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Inga-Karin Petersson Inga-Karin Petersson

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00513

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 28/08/92
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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